



# Town of Whitehall

Water Treatment Facility and System Improvements

Jason Crawford, PE/Owner

# Project Background

- ▶ Radiological MCL & Whitehall Results
  - ▶ Uranium
    - ▶ EPA MCL - 30 microgram/L
    - ▶ **Whitehall Avg - 30-40 micrograms/L**
    - ▶ Typically, not tested
  - ▶ Gross Alpha
    - ▶ EPA MCL - 15 picocuries/L
    - ▶ **Whitehall Avg - 10-15 picocuries/L**
    - ▶ Typically tested every 9 years
    - ▶ Violation in 2014
      - ▶ 26 picocuries/L
- ▶ Began Quarterly Uranium Testing in 2015
- ▶ January 2017 - AOC with DEQ



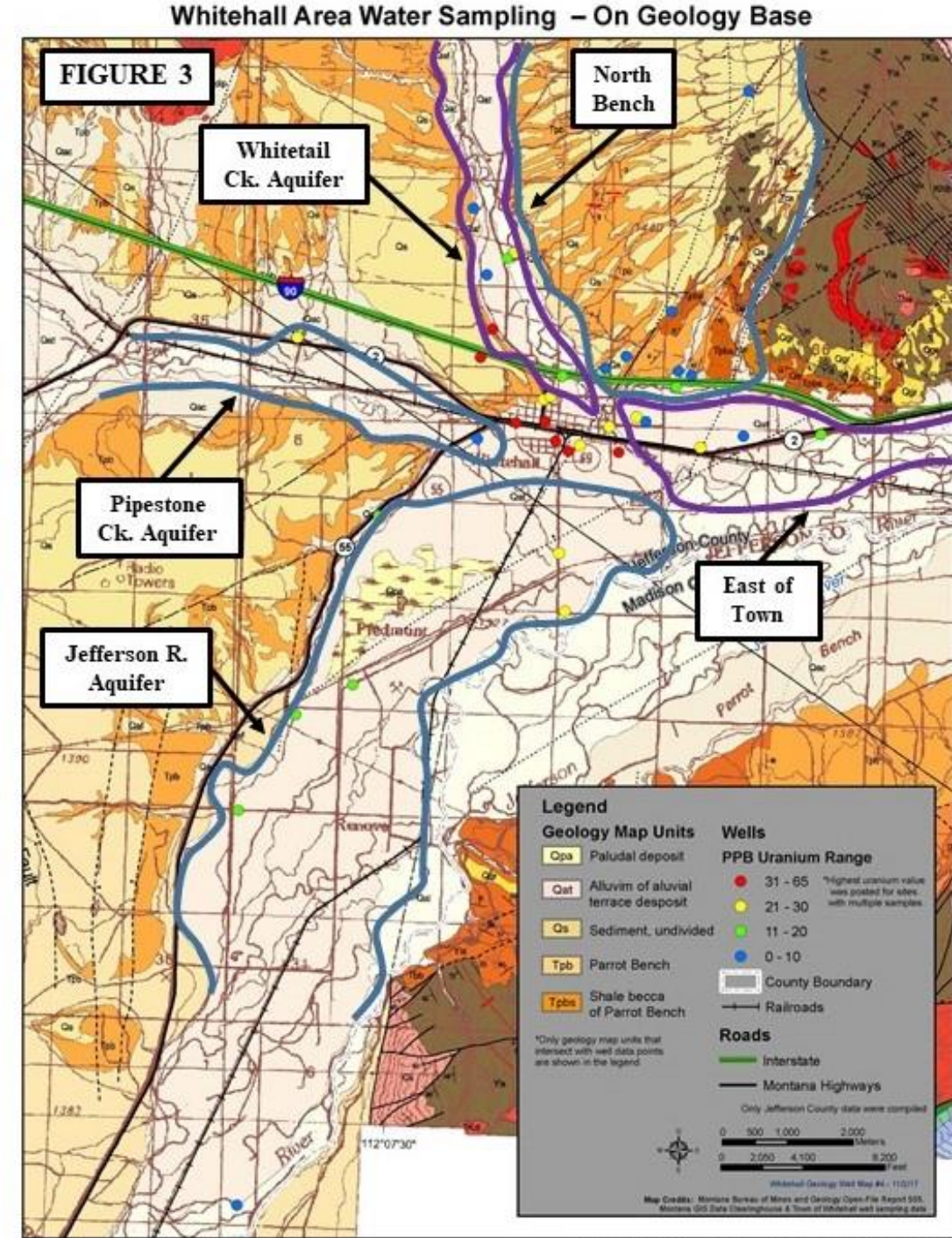
TRIPLE TREE  
ENGINEERING

**Whitehall Admin. Order on Consent** – “Failure to fulfill the requirements of this Consent Order by the specified timeframes, as ordered herein, constitutes a violation of Title 75, chapter 5, part 6, MCA, and may result in the Department seeking a court order requiring additional corrective action and assessing civil penalties.”



# Preliminary Work

- ▶ May 2018 - Orig. PER & Funding Applications
- ▶ December 2018 & December 2019 - PER Updates
  - ▶ Alternatives Considered in PER's
    - ▶ 1 - No Action
    - ▶ 2 - New Surface Water Source
    - ▶ 3 - New Ground Water Source
    - ▶ 4 - IX Treatment Plant in a New Building
      - ▶ A - Using 1 Existing Well and 1 New Well
      - ▶ B - Using Both Existing Wells
    - ▶ 4C - IX Treatment Plant in Exist. Building
      - ▶ Using Both Existing Wells
    - ▶ 4D - IX Treatment Plant in Amb. Building
      - ▶ Using Existing Wells
      - ▶ Using 1 Existing and 1 New Well
    - ▶ 5 - Tank Improvements and Dist. System Improvement





# Project Scope

- ▶ Project Scope
  - ▶ IX Treatment Plant in a New Building Using the Existing Two Wells
  - ▶ Recoat the Tank
  - ▶ Misc. Dist. System Improvements

*Montana Bureau of Mines and Geology* speculates that the uranium in the Whitehall area may be higher in Tertiary sediments because they contain considerable fragments of the Boulder Batholith and related rocks. Ground water moving through this coarse material could acquire uranium from the fragmental uranium-rich sediments.



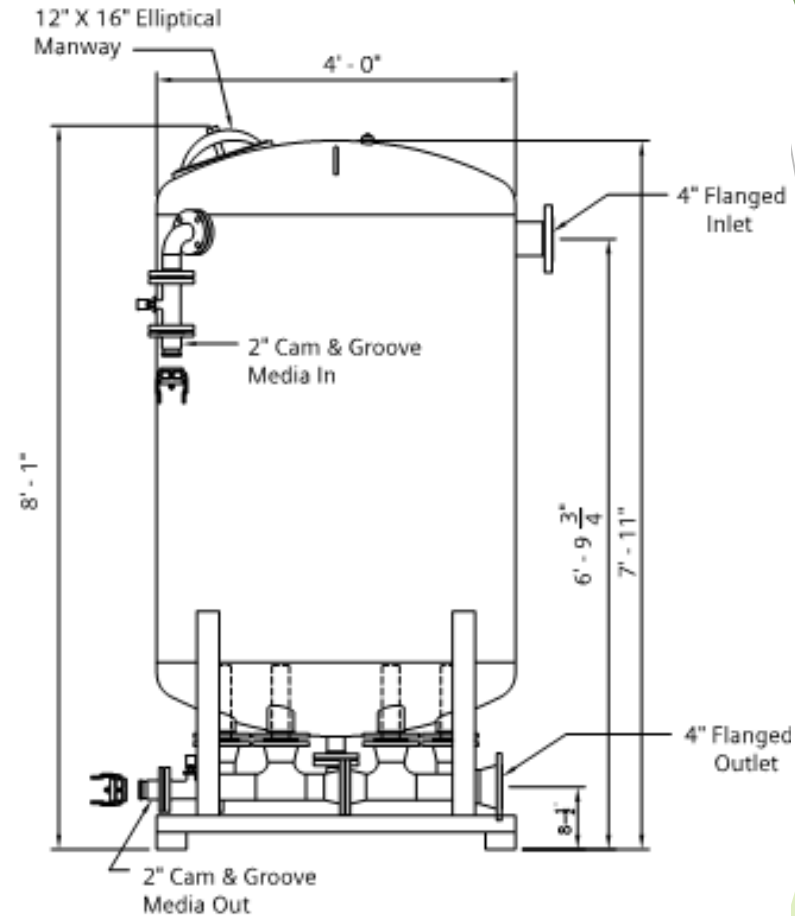
**TRIPLE TREE**  
ENGINEERING



# Ion Exchange Treatment

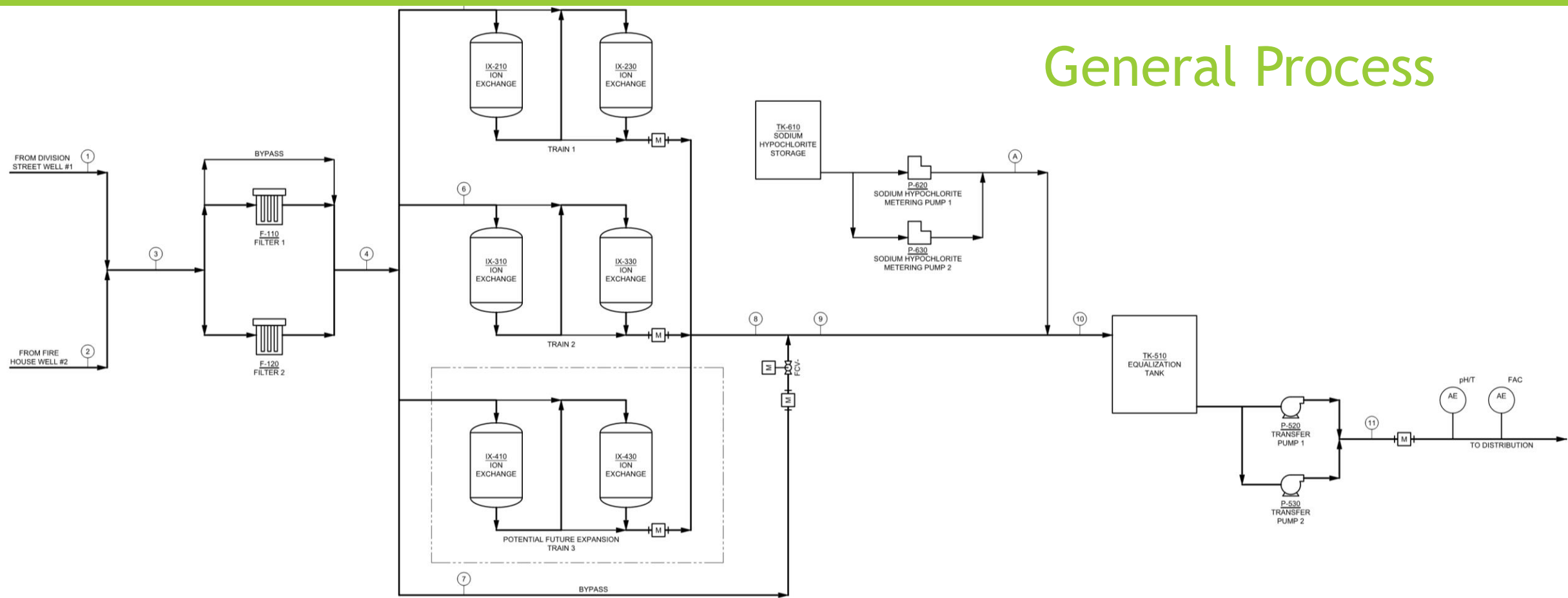
- ▶ Water is Passed Through IX Vessel
  - ▶ Anion exchange resin
  - ▶ 220 gpm min. and 340 gpm max. flow
- ▶ Use Resin to Exhaustion and Dispose
  - ▶ Concentrating uranium is highly regulated
    - ▶ Utilize a licensed radiation safety contractor
    - ▶ Closest disposal site is in Clive, Utah
- ▶ O&M Costs
  - ▶ Treat 50% of the flow to maximize resin use
  - ▶ Replace resin every 4 years
  - ▶ \$20,000/yr budgeted to replace the resin

**US EPA** – “Ion exchange has been identified by EPA as a “best available technology”(BAT) and Small System Compliance Technology (SSCT) for radium, uranium, gross alpha, and beta particle and photon emitters. It can remove up to 99 percent of these contaminants depending on the resin, pH, and competing ions. Ion exchange resins are regenerated by a series of steps, including backwashing, brining, and rinsing. Ion exchange vessels typically have a service capacity of 200 to 1,500 bed volumes (BV) for radium, as a function of water hardness, and 100,000 to 300,000 BV for uranium.”



**TRIPLE TREE**  
ENGINEERING

# General Process



## MASS BALANCE

| PROCESS STREAM DESCRIPTION   |       | DIVISION STREET WELL #1 TO FILTERS | FIRE HOUSE WELL #2 TO FILTERS | COMBINED RAW WATER INFLUENT <sup>1/</sup> | FILTERS TO IX INFLUENT MANIFOLD | INFLUENT TO IX TRAIN 1 <sup>2/</sup> | INFLUENT TO IX TRAIN 2 <sup>2/</sup> | IX BYPASS | IX EFFLUENT | COMBINED IX EFFLUENT/BYPASS <sup>3/</sup> | COMBINED IX EFFLUENT/BYPASS | TRANSFER PUMPS TO DISTRIBUTION |
|--|-------|------------------------------------|-------------------------------|---|---------------------------------|--------------------------------------|--------------------------------------|-----------|-------------|---|-----------------------------|--------------------------------|
| STREAM NUMBER  | UNITS | 1                                  | 2                             | 3   | 4                               | 5                                    | 6                                    | 7         | 8           | 9   | 10                          | 11                             |
| <b>OPERATING SCENARIO 1: PER AVERAGE DAY WATER DEMAND (216,000 GPD; 1 TRAIN OPERATED AT 10 HR PER DAY)</b> |       |                                    |                               |   |                                 |                                      |                                      |           |             |   |                             |                                |
| DESIGN FLOW  | GPM   | TBD                                | TBD                           | 360                                       | 360                             | 223                                  |                                      | 137       | 223         | 360                                       | 360                         | 360                            |
| AVERAGE TOTAL URANIUM CONCENTRATION  | µg/L  | 32.5                               | 40.9                          | 40.9                                      | 40.9                            | 40.9                                 |                                      | 40.9      | < 1         | 16.2                                      | 16.2                        | 16.2                           |
| MAXIMUM TOTAL URANIUM CONCENTRATION  | µg/L  | 46.3                               | 55.9                          | 55.9                                      | 55.9                            | 55.9                                 |                                      | 55.9      | < 1         | 21.9                                      | 21.9                        | 21.9                           |
| <b>OPERATING SCENARIO 2: PER PEAK DAY WATER DEMAND (666,000 GPD; 1 TRAIN OPERATED AT 24 HR PER DAY)</b>    |       |                                    |                               |   |                                 |                                      |                                      |           |             |   |                             |                                |
| DESIGN FLOW  | GPM   | TBD                                | TBD                           | 462                                       | 462                             | 287                                  |                                      | 176       | 287         | 462                                       | 462                         | 462                            |
| AVERAGE TOTAL URANIUM CONCENTRATION  | mg/L  | 32.5                               | 40.9                          | 40.9                                      | 40.9                            | 40.9                                 |                                      | 40.9      | < 1         | 16.2                                      | 16.2                        | 16.2                           |
| MAXIMUM TOTAL URANIUM CONCENTRATION  | µg/L  | 46.3                               | 55.9                          | 55.9                                      | 55.9                            | 55.9                                 |                                      | 55.9      | < 1         | 21.9                                      | 21.9                        | 21.9                           |
| <b>OPERATING SCENARIO 3: PEAK SUMMER WATER DEMAND (864,000 GPD; 2 TRAINS OPERATED AT 20 HR PER DAY)</b>    |       |                                    |                               |   |                                 |                                      |                                      |           |             |   |                             |                                |
| DESIGN FLOW  | GPM   | TBD                                | TBD                           | 720                                       | 720                             | 223                                  | 223                                  | 274       | 446         | 720                                       | 720                         | 720                            |
| AVERAGE TOTAL URANIUM CONCENTRATION  | mg/L  | 32.5                               | 40.9                          | 40.9                                      | 40.9                            | 40.9                                 | 40.9                                 | 40.9      | < 1         | 16.2                                      | 16.2                        | 16.2                           |
| MAXIMUM TOTAL URANIUM CONCENTRATION  | mg/L  | 46.3                               | 55.9                          | 55.9                                      | 55.9                            | 55.9                                 | 55.9                                 | 55.9      | < 1         | 21.9                                      | 21.9                        | 21.9                           |
| <b>OPERATING SCENARIO 4: MAXIMUM FLOW THROUGH 1 TRAIN (787,000 GPD; 1 TRAIN OPERATED AT 24 HR PER DAY)</b> |       |                                    |                               |   |                                 |                                      |                                      |           |             |   |                             |                                |
| DESIGN FLOW  | GPM   | TBD                                | TBD                           | 547                                       | 547                             | 339                                  |                                      | 208       | 339         | 547                                       | 547                         | 547                            |
| AVERAGE TOTAL URANIUM CONCENTRATION  | mg/L  | 32.5                               | 40.9                          | 40.9                                      | 40.9                            | 40.9                                 |                                      | 40.9      | < 1         | 16.2                                      | 16.2                        | 16.2                           |
| MAXIMUM TOTAL URANIUM CONCENTRATION  | mg/L  | 46.3                               | 55.9                          | 55.9                                      | 55.9                            | 55.9                                 |                                      | 55.9      | < 1         | 21.9                                      | 21.9                        | 21.9                           |

## NOTES:

1. COMBINED RAW WATER INFLUENT SET TO THE MAXIMUM URANIUM CONCENTRATION FOR THE PURPOSES OF THIS MASS BALANCE. THE ACTUAL INFLUENT CONCENTRATION WILL VARY WITH CONCENTRATION AND THE RELATIVE FLOW RATES OF EACH WELL.
2. STREAM 7 IDENTICAL TO STREAM 8 WHEN IX TRAIN 2 IN SERVICE AND IX TRAIN 1 IN STANDBY FOR SCENARIOS 1, 2, AND 4.
3. URANIUM MCL IS 30 µg/L. URANIUM TREATMENT TARGET IS ≤ 22 µg/L.
4. MINIMUM FLOW THROUGH IX VESSELS IS 220 GPM; MAXIMUM FLOW IS 340 GPM.
5. MAXIMUM BYPASS FLOW RATE IS 38% OF TOTAL FLOW.

## 12.5% SODIUM HYPOCHLORITE ADDITION

| STREAM NUMBER | UNITS | A MIN | A MAX |
|---------------|-------|-------|-------|
| DOSE          | mg/L  | 0.5   | 4     |
| SCENARIO 1    | GPH   | 0.07  | 0.58  |
| SCENARIO 2    | GPH   | 0.09  | 0.74  |
| SCENARIO 3    | GPH   | 0.14  | 1.15  |
| SCENARIO 4    | GPH   | 0.11  | 0.88  |

*US Department of Health and Human Services (DHHS) Fact Sheet CAS #7440-61-1 -*

“Natural uranium and depleted uranium have the identical chemical effect on your body. Kidney damage has been seen in humans and animals after inhaling or ingesting uranium compounds.”



# Funding

## ► Current Project Budget

### ► \$6.3M - Total Project Cost

- \$625K - TSEP Grant- Awarded 5/2019
- \$125K - RRGL Grant - Awarded 5/2019
- \$450K - CDBG Grant - Awarded 6/2019
- \$270K - WRDA Grant - Awarded 8/2020
- \$2M - ARPA Grant- Awarded 10/2021
- \$200K - EPA WIIN Grant - Awarded 2/2022
- \$3.67M - Total Grant
  
- \$900K - USDA RD Loan - Obligated 5/2020
- \$700K - USDA RD Loan - After Bid 9/2022
- \$1M - SRF Loan - Application 2/2022
- \$30K - Local Contribution



TRIPLE TREE  
ENGINEERING

**WHITEHALL WATER TREATMENT PLANT IMPROVEMENTS**

**Project Budget**

|                                       | COMMITTED FUNDS                      |                  |                             |                                      |                  |                             |                  |                  |                       | Total              |
|---------------------------------------|--------------------------------------|------------------|-----------------------------|--------------------------------------|------------------|-----------------------------|------------------|------------------|-----------------------|--------------------|
|                                       | OTHER - WRDA, USDA,<br>RD, SFR, ETC. | EPA WIIIN GRANT  | ARPA - COMPETITIVE<br>GRANT | Montana Coal<br>Endowment<br>Program | CDBG             | Renewable<br>Resource Grant | USACE WRDA1      | USDA RD          | Local<br>Contribution |                    |
| Personnel Costs                       |                                      |                  |                             | \$1,000                              |                  |                             |                  |                  |                       | \$1,000            |
| Office Costs                          |                                      |                  |                             | \$1,000                              |                  |                             |                  |                  |                       | \$1,000            |
| WRDA Grant Admin completed by<br>WRDA |                                      |                  |                             |                                      |                  |                             | \$30,000         |                  |                       | \$30,000           |
| Grant and Loan Admin                  |                                      |                  | \$25,000                    |                                      | \$15,000         |                             |                  | \$15,000         |                       | \$55,000           |
| Legal Costs                           |                                      |                  |                             |                                      |                  |                             |                  | \$3,500          |                       | \$3,500            |
| Interim Interst                       |                                      |                  |                             |                                      |                  |                             |                  | \$15,000         |                       | \$15,000           |
| Audit Fees                            |                                      |                  | \$12,000                    |                                      |                  |                             |                  |                  | \$3,000               | \$15,000           |
| Travel & Training                     |                                      |                  |                             | \$500                                |                  |                             |                  |                  |                       | \$500              |
| Bond Costs                            |                                      |                  |                             |                                      |                  |                             |                  | \$20,000         |                       | \$20,000           |
|                                       |                                      |                  |                             |                                      |                  |                             |                  |                  |                       | \$0                |
| <b>TOTAL ADMINISTRATION</b>           | <b>\$0</b>                           | <b>\$0</b>       | <b>\$37,000</b>             | <b>\$2,500</b>                       | <b>\$15,000</b>  | <b>\$0</b>                  | <b>\$30,000</b>  | <b>\$53,500</b>  | <b>\$3,000</b>        | <b>\$141,000</b>   |
|                                       |                                      |                  |                             |                                      |                  |                             |                  |                  |                       |                    |
| Preliminary Engineering               |                                      |                  |                             |                                      |                  |                             |                  |                  | \$5,000               | \$5,000            |
| Engineering Design                    |                                      | \$200,544        |                             | \$99,456                             |                  | \$125,000                   | \$27,400         |                  | \$22,000              | \$474,400          |
| Construction Engineering Services     |                                      |                  | \$207,955                   |                                      | \$100,000        |                             | \$115,620        |                  |                       | \$423,575          |
| Construction                          | \$850,253                            |                  | \$1,552,090                 | \$485,018                            | \$304,474        |                             | \$89,935         | \$791,958        |                       | \$4,073,728        |
| Contingency                           | \$852,174                            |                  | \$202,955                   | \$38,026                             | \$30,526         |                             | \$7,045          | \$54,542         |                       | \$1,185,268        |
|                                       |                                      |                  |                             |                                      |                  |                             |                  |                  |                       |                    |
| <b>TOTAL ACTIVITY</b>                 | <b>\$1,702,427</b>                   | <b>\$200,544</b> | <b>\$1,963,000</b>          | <b>\$622,500</b>                     | <b>\$435,000</b> | <b>\$125,000</b>            | <b>\$240,000</b> | <b>\$846,500</b> | <b>\$27,000</b>       | <b>\$6,161,971</b> |
|                                       |                                      |                  |                             |                                      |                  |                             |                  |                  |                       |                    |
| <b>TOTAL PROJECT BUDGET</b>           | <b>\$1,702,427</b>                   | <b>\$200,544</b> | <b>\$2,000,000</b>          | <b>\$625,000</b>                     | <b>\$450,000</b> | <b>\$125,000</b>            | <b>\$270,000</b> | <b>\$900,000</b> | <b>\$30,000</b>       | <b>\$6,302,971</b> |



# Summary of Ground Water Report

According to the Ground Water Report the three best options for a new ground water source are the North Bench, the Aquifer East of Town, and the Pipestone Creek Aquifer.

The North Bench had the lowest uranium values but still tested positive for uranium in 5 of the 7 samples. The wells on the North Bench only yield between 30 and 100 gpm and the Ground Water Report suggested “yields in the North Bench are questionable”.

In comparison to the North Bench, Higher levels of uranium were detected in the Aquifer East of Town and the Pipestone Creek Aquifer. According to the report the Aquifer East of Town contains substantial volumes of high-yield coarse channelized gravels.

The Ground Water Report suggests that higher pumping rates may increase uranium levels and that ground water moving through this coarse material could acquire uranium from the fragmental uranium-rich sediments. New wells on the North Bench, in the Aquifer East of Town, and in the Pipestone Creek Aquifer show low initial uranium levels but once wells are put into regular production it is possible they could begin to show elevated levels of uranium as more ground water is pumped from the aquifers.

At this time, there is no clear evidence suggesting that a reliable uranium free groundwater aquifer is available nor clear evidence to support new wells not becoming contaminated with uranium once they are put into regular production. Since we do not have a reliable uranium free groundwater source, the New Ground Water Source Alternative will **NOT** be considered further in this report.





**TRIPLE TREE**  
ENGINEERING

**USGS** – “Naturally radioactive constituents are found as trace elements in most rocks and soils and are formed principally by the radioactive decay of uranium-238 and thorium-232 (Zapecza and Szabo, 1988).....during decay of uranium, alpha and beta particles are emitted and radium and radon are formed as interim radiogenic daughter products; these, in turn, ultimately decay to a stable form of lead...”

**DEQ** – “Systems are required to monitor the microbial, chemical and radiological quality of the water they produce on a periodic basis. Monitoring frequency is based on the chemical or contaminant. Some chemicals are monitored continuously; others are monitored daily, monthly, annually, triennially, and for some situations sampling is conducted every 9 years.”